
Equipment

Required firmware

To implement the Binary 8 Zero Substitution (B8ZS) feature requires CPU ROM firmware that is compatible with X11 release 19 software.

Installation-dependent hardware

The following hardware may be required, depending upon the specific installation:

- Echo Cancellor

A Tellabs 24 Channel Echo Cancellor, or the equivalent, should be used for echo cancellation on DTI voice calls over satellite only.

- Channel Service Unit

Depending on local or national regulations (for example, Part 68 of FCC regulations), connections to registered common carrier trunks may require that Network Channel Terminating Equipment (NCTE) be provided at the demarcation point. Digilink, Verilink, or similar Channel Service Units (CSUs) can be used.

- Test equipment

A Thor Error Counter, or equivalent, should be used for testing bipolar violations (BPV) on DTI circuits.

Required hardware

To implement the DTI feature, Meridian 1 uses:

- QPC472 Digital Trunk Interface or QPC720 Primary Rate Interface (PRI)

The DTI card or PRI card is associated with a Meridian 1 Network loop and forms the interface between the loop and a DS-1 24-channel 1.544 Mbps bipolar carrier terminal.

Note 1: DTI loops that use the Binary 8 Zero Substitution (B8ZS) feature must be QPC720 packs or equivalents.

Note 2: This feature applies to the 1.544 Mbps DTI only. DTI2/PRI2 is not supported.

DTI card location Each DTI card occupies two adjacent slots of a CPU shelf or a Network shelf. The specific location depends on the:

- machine type
- mode of operation
- availability of space

As many as six DTI cards can be plugged into a spare Network shelf along with a power converter card.

- QPC471 or QPC775 Clock Controller (CC)

Clock Controllers are required when the Meridian 1 is synchronized to an external source clock, such as AT&T Stratum 3 (all DTI applications and CPI applications where the host and CPI are remote and require a repeated facility). The CC generates and distributes clock signals to the system.

Note 1: The QPC775 Clock Controller card is currently only available in Canada and the international market.

Note 2: The QPC471 and QPC775 Clock Controllers cannot be intermixed in one system.

Note 3: For the CPI application, in most cases a Clock Controller is not required.

Note 4: Option 81 systems require QPC471 vintage H or later.

QPC472 and QPC720 hardware description

Physical description

The QPC472 and QPC720 cards consist of two PCBs arranged into a single assembly in a mother/daughter configuration. The Network Interface (NI) PCB serves as the motherboard. It connects through a 60-pin ribbon cable to the Carrier Interface (CI) PCB daughterboard.

Note 1: QPC472 card's daughterboard is the QPC473.

Note 2: QPC720 card's daughterboard is the QPC752.

The DTI card draws power through the backplane connector of the Network Interface (NI). NI faceplate mounted connectors J1 and J2 extend through the faceplate and connect by cable to the Clock Controller when the DTI card is used as a reference clock source. J3 connects by cable to the Network loop.

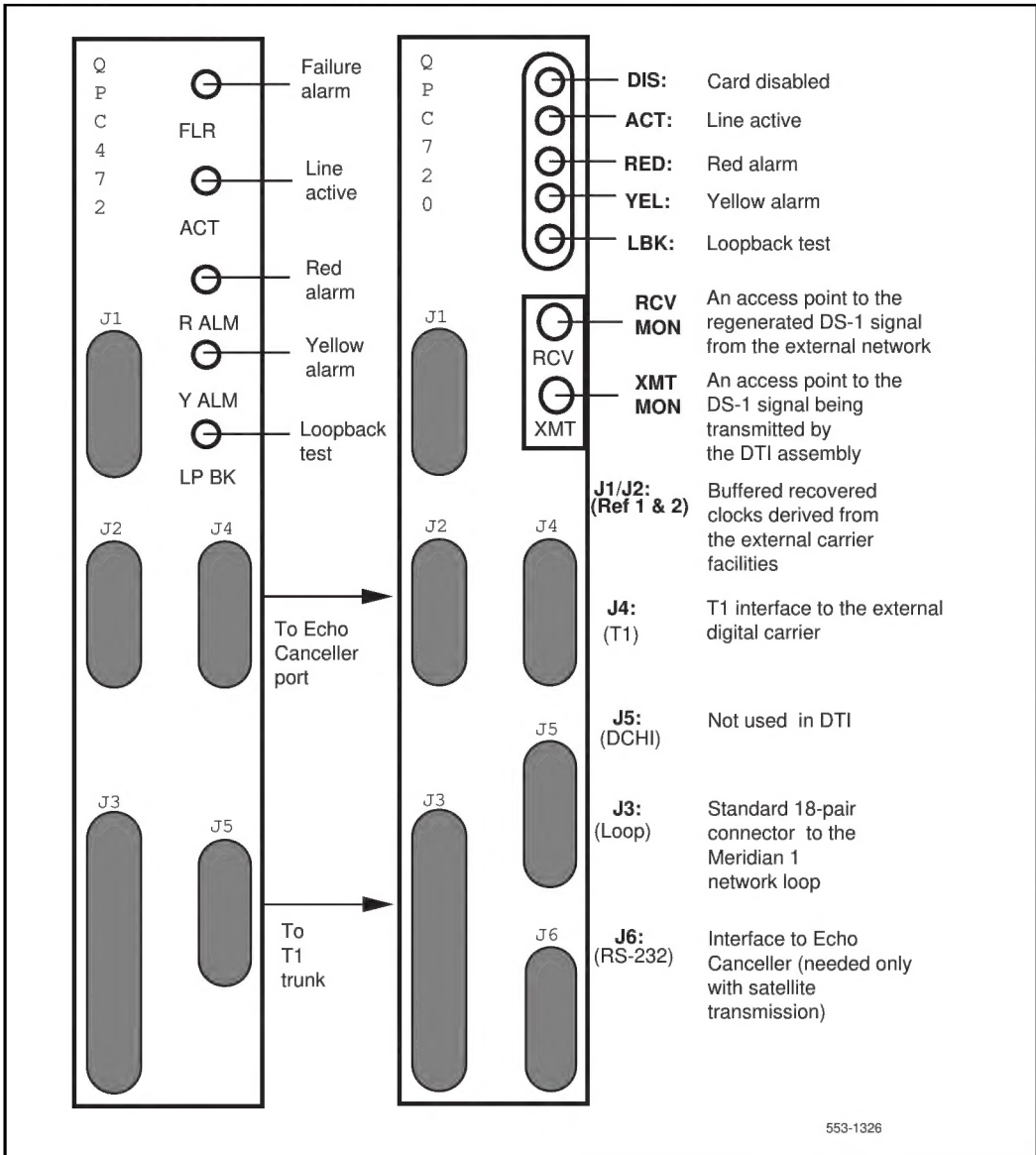
Because of its power requirements, a QPC472 or QPC720 card must be plugged into a network or CPU backplane.

QPC472 J4 and J5 Extending through the faceplate from the daughterboard are connectors J4 and J5. J4 connects by cable to the Echo Cancellor. J5 connects by cable to the T1 trunk.

See **Figure 6** for card faceplate jacks and LED locations.

QPC720 J4, J5, and J6 Extending through the faceplate from the daughterboard are connectors J4, J5, and J6. J4 connects by cable to the T1 trunk. J5 is not used in DTI/CPI applications. J6 connects by cable to the Echo Cancellor.

Figure 6
QPC472/QPC720 faceplate jacks and LEDs



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Faceplate LEDs

QPC472 The LEDs on the QPC472 faceplate indicate the following states:

FLR	DTI failed or is disabled if ON
ACT	DTI active if ON
RALM	DTI local (red) alarm
YALM	DTI remote (yellow) alarm
LP BK	DTI in loopback test state if ON

QPC720 The LEDs on the QPC720 faceplate indicate the following states:

DIS	DTI failed or is disabled if ON
ACT	DTI active if ON
RED	DTI local (red) alarm
YEL	DTI remote (yellow) alarm
LBK	DTI in loopback test state if ON

Transmission equalizer switch

Making appropriate DIP switch settings on the Carrier Interface (CI) (daughterboard) card of the DTI card achieves transmission equalization. Transmission equalization is needed to compensate for cable-induced amplitude and phase distortions.

QPC472 card The DIP switch is located on the QPC473 daughterboard and is labeled SW1. The switch consists of eight poles. Poles one through seven are used for DTI applications.

QPC720 card The DIP switch is located on the QPC752 daughterboard and is labeled SW2. The switch consists of seven poles. All seven poles are used for DTI applications.

See **Figure 7** and refer to **Tables 4** and **5** for DIP switch locations and settings.

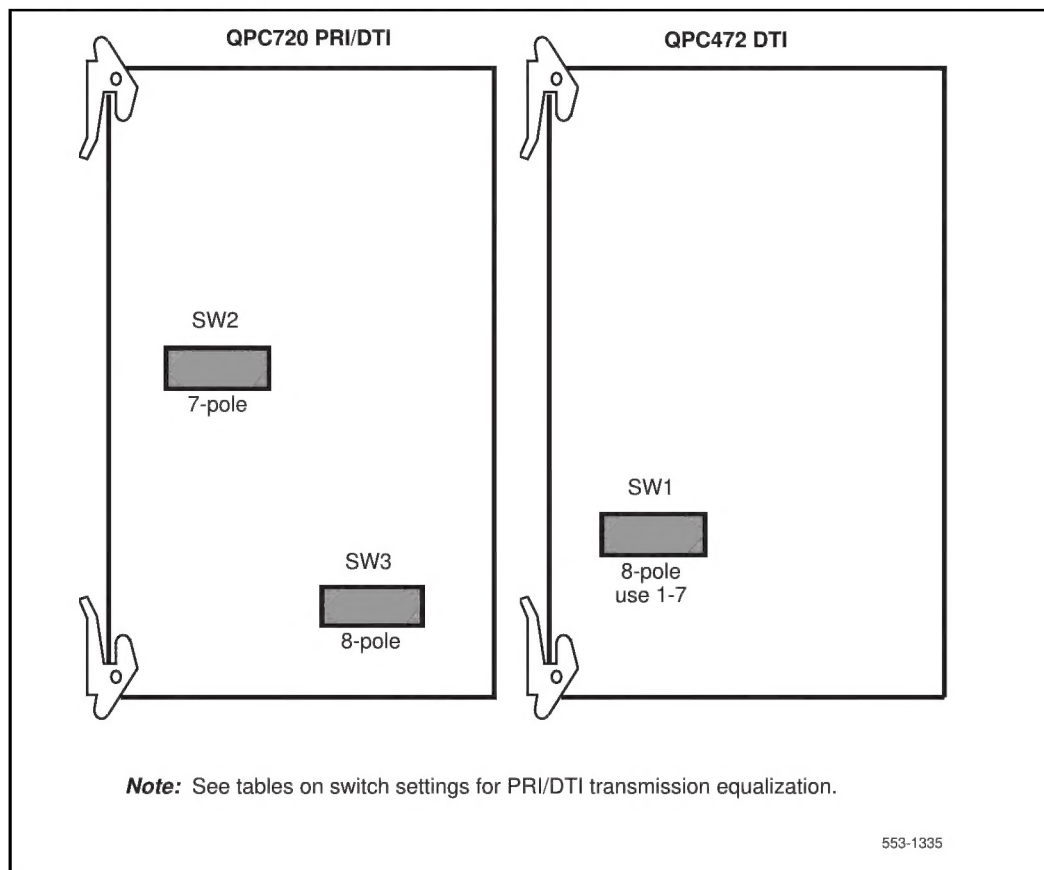
Table 4
QPC472 transmission equalization switch settings for DTI

Switch settings (transmission equalization)	To repeatered facility	To cross-connect point
5 on	0 - 45 m (0 - 150 ft)	0 - 15 m (0 - 55 ft)
2, 4, 6, on	45 - 135 m (150 - 450 ft)	15 - 100 m (56 - 355 ft)
1, 3, 7, on	135 - 225 m (450 - 750 ft)	100 - 200 m (355 - 655 ft)
Note: All switch positions should be OFF except those under the "switch settings" column.		

Table 5
QPC720 transmission equalization SW2 switch settings for PRI/DTI

Switch S2 settings	To repeatered facility	To cross-connect point
5 on	0 - 45 m (0 - 150 ft)	0 - 30 m (0 - 100 ft)
2, 4, 6 on	46 - 135 m (151 - 450 ft)	31 - 100 m (101 - 355 ft)
1, 3, 7 on	136 - 225 m (451 - 750 ft)	101 - 200 m (356 - 655 ft)
Switch 3 options for PRI/DTI with ESF		
SW3-1	on =	extended superframe format (ESF)
SW3-2	off =	superframe format (SF)
	on =	B8ZS line encoding
	off =	AM1 line encoding
SW3-3	on =	facility data link (FDL) yellow alarm method
	off =	Digit 2 yellow alarm method
Note 1: All positions on S2 (location B22) are OFF except as shown under the column labeled “Switch S2 settings.” The 8-pole SW3 (location E37) positions are OFF except as shown for “Switch 3 options for PRI/DTI with ESF.”		
Note 2: For D2, D3, or D4 framing formats (superframe formats), set all SW3 options to OFF.		

Figure 7
QPC472/QPC720 DIP switch locations and settings



Faceplate connectors

J1, J2 reference clock The DTI card is equipped with two 9-pin PCB mounted connectors designated J1 and J2. If the DTI is defined as the primary reference clock source, DTI connector J1 is cabled to CC0 connector J2 and DTI connector J2 is cabled to CC1 connector J2. If the DTI is defined as the secondary reference clock source, DTI connector J1 is cabled to CC0 connector J1 and DTI connector J2 is cabled to CC1 connector J1.

J3 Network Loop The 36-pin DTI connector J3 is cabled to the 36-pin connector (even or odd) of its assigned Network loop.

QPC472 J4/QPC720 J6 Echo Cancellor The DTI/Echo Cancellor controller interface is made through the 15-pin female connector. The DTI is a data terminal equipment (DTE) RS-232 interface. Its pin assignments and interconnections are shown in [Table 6](#).

Table 6
DTI/Echo Cancellor RS-232-C interface pin assignments

Signal	EIA RS-232-C circuit designation	Echo Cancellor pin	DTI pin
Transmitted Data (TXD)	BA	5	2
Received Data (RXD)	BB	2	3
Request to Send (RTS)	CC	—	4
Clear to Send (CTS)	CB	—	5
Signal Ground (common return)	AB	10	7
Received Line Signal Detector (DCD)	CF	1	8
Data Terminal Ready (DTR)	CD	4	20

QPC472 J5/QPC720 J4 Carrier Interface The DTI interface to the carrier, by means of the Echo Cancellor (if required), is made through the 15-pin connector. The pinouts at the DTI end are shown in **Table 7**.

Table 7
DTI/QPC472 J5/QPC720 J4 Carrier Interface pinouts

Pin	Signal	Pin	Signal
1	XTIP	3	RTIP
9	XRING	11	RRING
2	GRD	4	GRD

***Note:** See Digital Trunk Interface/Computer-to-PBX Interface installation and data administration (553-2811-200) for DTI cabling details.*

QPC471 and QPC775 Clock Controllers

The QPC471 and QPC775 Clock Controller (CC) cards provide Stratum 3 clocking to an external facility and can therefore control synchronization. It can also synchronize the Meridian 1 Network to an external source clock and generate and distribute a clock signal to the system.

The Meridian 1 accepts several vintages of the QPC471. The QPC471H is required for option 81.

The QPC775A (currently available in Canada only) CC card is compatible with the N, NT, XN, XT, MS, ST, and RT machine types.

***Note:** The QPC471 and QPC775 cannot be intermixed in one system.*

The CC is contained on a 12.5 in. (32 cm) by 10 in. (25 cm) printed card. The CC connects with other circuits through a 120-pin backplane connector (P1) and through two 9-pin PCB-mounted connectors, J1 and J2. J1 and J2 extend through the faceplate and through a 50-pin faceplate mounted connector, J3. An Enable/Disable switch and LED are also located on the CC faceplate.

Clock Controller Enable/Disable switch and indicator

When the Enable/Disable switch has been used to disable the CC, the LED is turned on and the CC does not distribute clock signals. CC Enable and Disable are also under CPU control and that of the DTI hardware diagnostic, LD60.

Clock Controller card location CC cards are located as follows:

- XN: CPU shelf
- XT: CPU/MEM shelf slot 14 or 15
- N, RT: Network shelf slot 13
- MS: CE shelf slot 9
- ST, STE: Common equipment (CE) shelf slots 5 through 8 or 10 through 12
- NT: Network shelf 0 (half group) slot 13; Network shelf 1 (single group) slot 2
- 21, 21E: CE/peripheral equipment (PE) Network slots 4 through 7
- 51: CPU/Network slot 9

For dual CPU systems, two CC cards are required (one for each CPU), in the following locations:

- 61: CPU/Network slot 9
- 71: CPU slot 14
- 81: Core slot 6 (requires QPC471 vintage H)

Depending on the configuration of the Meridian 1, DTI and CC cards are arranged differently. Note that only the first two DTI cards are connected to the CCs. All other DTI cards are connected only to Network cards. This is because the Meridian 1 either slaves to the carrier clocking by means of the Stratum 3 level CC or provides clock to the carrier.

In dual CPU systems, CC redundancy is provided for each CPU. Northern Telecom recommends that dual CPU systems operate with CCs of the same vintage. In addition, any two, but only two, DTI cards are connected to the CC cards for further backup. If one T1 link fails, the second DTI card can provide clocking to the CC cards. Any additional DTI cards receive clocking by means of the Network Signaling bus. **Figures 8 through 10** depict some typical arrangements.

Figure 8
XN and XT multi-group operation

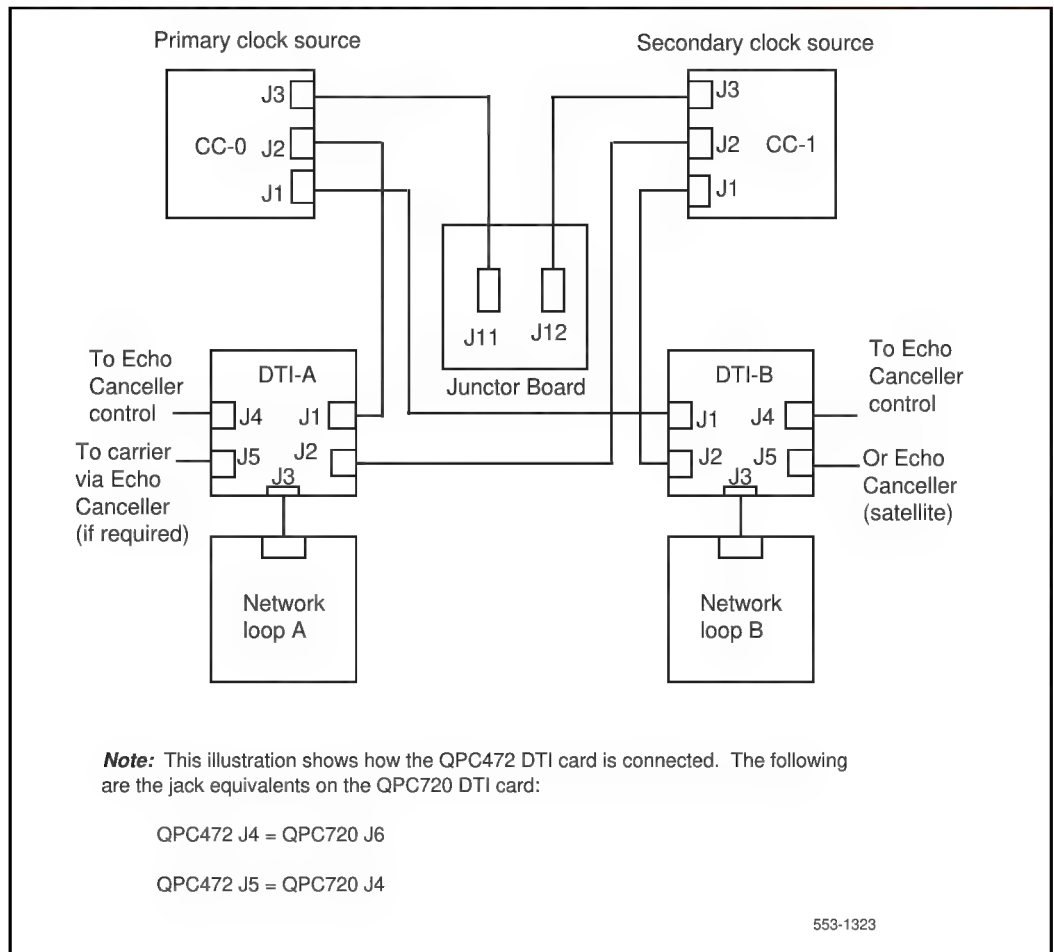


Figure 9
N and NT single-group operation

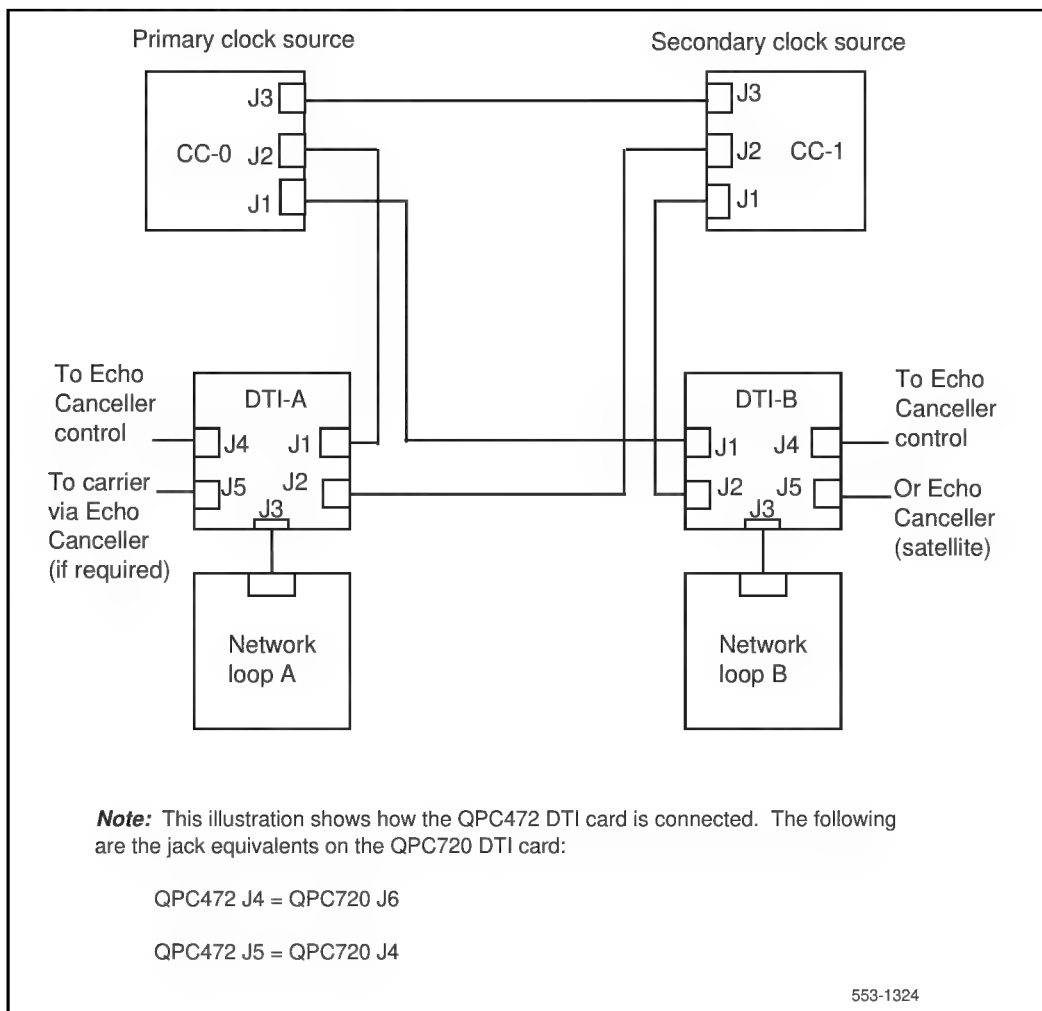
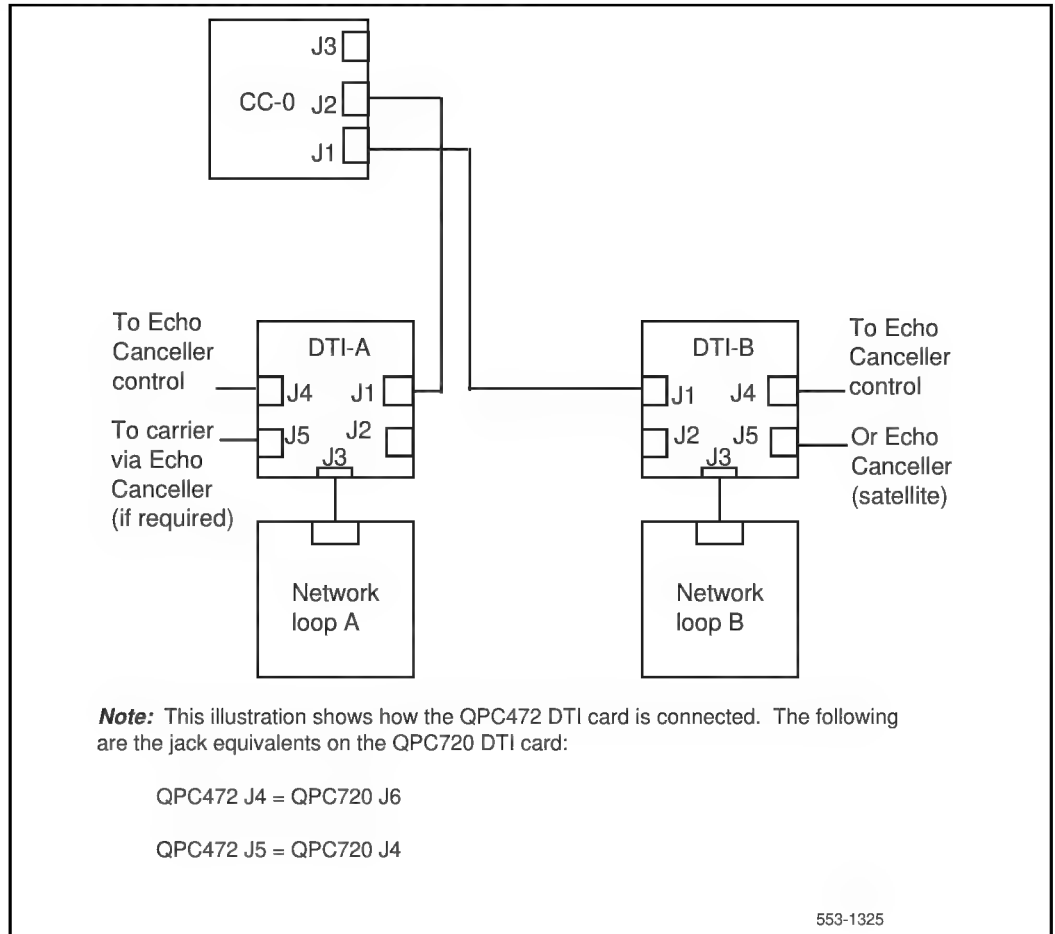


Figure 10
N, NT, MS, ST, and RT half-group operation



Clock Controller switch settings

Switch settings for the Clock Controller are shown in [Tables 8 and 9](#).

Table 8

QPC471 vintages A through G Clock Controller switch settings

Vintage	Switch	MS	ST, STE, 21A, 21	N, NT, RT, 51, 61	XN, XT, 71, 81
QPC471A	SW2	not applicable	not applicable	ON	OFF
QPC471B through G	SW1	ON	ON	ON	OFF
	SW2	ON	OFF	OFF	OFF
	Jumper F38	TP9-TP10	TP8-TP9	TP8-TP9	TP8-TP9
	Jumper G38	TP12-TP13	TP11-TP12	TP11-TP12	TP11-TP12
QPC775	SW2	ON	ON	ON	OFF
	SW3	ON	OFF	OFF	OFF
	SW4(1, 2)	OFF	ON	ON	ON
Note 1: ON means 1 or CLOSED Note 2: OFF means 0 or OPEN. Note 3: The QPC775 Clock Controller card is currently available in Canada only.					

Table 9
QPC471 vintage H Clock Controller switch settings

System	SW1				SW2				SW4			
	1	2	3	4	1	2	3	4	1	2	3	4
ST, STE, 21A, 21, 21E	on	on	on	on	off	off	off	off	off	off	off	off
MS, SN	on	on	on	on	on	on	on	on	off	off	off	off
RT, N, NT, 51, 61	on	on	on	on	off	off	off	off	off	on	*	*
XN, XT, 71, 81	off	off	off	off	off	off	off	off	off	on	*	*
Cable length between the J3 faceplate connectors:												
0 - 4.3 m (0 - 14 ft)									off	off		
4.6 - 6.1 m (15 - 20 ft)									off	on		
6.4 - 10.1 m (21 - 33 ft)									on	off		
10.4 - 15.2 m (34 - 50 ft)									on	on		
* If there is only one clock controller card in the system, set to OFF. If there are two clock controller cards, set to match the cable length between the J3 faceplate connectors. Determine the total cable length (no single cable can exceed 25 ft) between the J3 connectors. Both cards must have the same setting.												

Clocks per system

The number of clocks used with the DTI is dependent on the Meridian 1 Network Group configuration. **Table 10** shows clocks required per system.

Table 10
Meridian 1 system clock requirements

Number of CC	Network Group	Meridian 1 type
2 (QPC471)	Multi-Group	XN, XT, 71
2 (QPC471)	Single-Group	N, NT, 61
1 (QPC471)	Half-Group	N, NT, RT, 51
1 (QPC471)	Half-Group	MS, ST, STE, 21, 21E
2 (QPC471H)	Multi-Group	81

Clock Controller interconnections

Backplane interface The CC interconnects with the CPU bus by means of the 120-pin backplane connector (P1).

Faceplate connectors The CC card is equipped with two 9-pin PCB-mounted connectors, designated J1 and J2. Connector J1 is associated with the DTI unit that is selected as the secondary reference clock source. J2 is associated with the DTI unit that is selected as the primary reference clock source. The CC is also equipped with a 50-pin, faceplate-mounted connector, designated J3. It is connected to the junctor board in Multi-Group mode, or directly to the other CC when Single-Group mode is used.

Note: CC cabling details are described in *Digital Trunk Interface/Computer-to-PBX Interface installation and data administration* (553-2811-200).

Interfacing with common carriers

The DTI provides an interface to the DS-1/D3 line either directly or by means of channel banks or office repeater. In accordance with FCC regulations (FCC 68), connections to registered common carrier trunks require that Network Channel Terminating Equipment (NCTE)—such as the NT QRY551 Channel Service Unit (CSU)—be provided at the demarcation point as long as the facility uses cable. (Microwave, fiber, infrared, and direct satellite connections do not require NCTE equipment.)

Echo Cancellor interface

The DTI provides both a T1 line interface and a control interface to a remotely controlled Echo Cancellor. The control interface is a serial link with a signal format compatible with EIA standard RS-232-C. Both the DTI and the Echo Cancellor act as data terminal equipment (DTE). Installation of the Echo Cancellor is covered in the manufacturer's documentation; however, the following guidelines outline the requirements for operation with DTI.

Physical interface The DTI/Echo Cancellor interface is made through a 15-pin D-type connector at the DTI end. See [Table 11](#).

Table 11
DTI/Echo Cancellor interface

Interface protocol	Serial link protocol
Mode	asynchronous
Data transfer rate	4800 baud
Duplex	full
Received characters echoed	yes
Parity	even
Start bits	1
Data bits	7
Stop bits	1

Command protocol All remote control commands consist of a sequence of four 7-bit ASCII characters as shown in [Table 12](#).

Table 12
Command protocol

Character	Description
1	System Unit Number (1)
2 & 3	Channel number being controlled (1-24)
4	Command Key (see Table 13)

There are two types of commands:

- **Control** Causes reconfiguration of the specified channel. The Echo Canceller must return an ACK (06 Hex) if the command is legal or a NACK (15 Hex) if the command is illegal.
- **Status** Monitors the existing configuration. The Echo Canceller must return a three-character response, the first two characters of which are the channel number. The third character is P (pass) or F (fail).

Table 13
Echo Canceller command keys

Command type	Command	On		Off	
		ASCII	Hex	ASCII	Hex
Control	bypass (Notes 1 & 3)	B	42	A	41
	off hook (Notes 2 & 3)	N	4E	O	4F
	canceller only (Note 4)	C	43	D	44
Status	self-test result (Notes 1 & 2)	T	54	—	—
Note 1: Echo cancellation is disabled when input is ON. Echo cancellation is active when the device performs a self-test. Note 2: Continuous echo cancellation takes place and self-testing is inhibited when input is ON. Note 3: When Bypass and Off Hook are entered simultaneously, the channel is removed from echo cancellation service. Note 4: Residual suppressor is disabled but cancellation circuitry remains active.					

Meridian 1

Digital Trunk Interface/ Computer-to-PBX Interface

Description

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